

UNIVERSITY OF MIAMI
Coral Gables, Florida

SEMIANNUAL STATUS REPORT

NASA GRANT NGR-10-007-010

May 1, 1966 - October 31, 1966

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STATUS REPORT

NASA GRANT NGR-10-007-010

UNIVERSITY OF MIAMI SUSTAINING UNIVERSITY MULTIDISCIPLINARY RESEARCH PROGRAM

I. GENERAL

Although the starting date of the grant was officially November 1, 1965, the actual award was not received by the University until March, 1966. Consequently, most programs discussed in this report have been active since April, 1966; some programs were even later in beginning due to the need to purchase equipment or recruit graduate students, which were not available in mid-semester when funds were allocated. Essentially, then, this report covers the scientific programs for approximately their first eight months of activity.

II. SCIENTIFIC ADMINISTRATION

The University Space Research Committee (a subcommittee of the University Research Council; see Appendix A) has been responsible for the formulation of the interdisciplinary program supported by the Sustaining Grant. The original membership of the committee was augmented to include additional disciplinary representation, particularly from the social sciences.

The committee operated under the general criteria stated in the original proposal of June, 1964 in selecting programs for support. These may be summarized:

(1) The program must be pertinent to the overall space research objectives of the University.

(2) The program should represent an extension of existing research into a space-related area, or the initiation of a new line of research.

(3) A significant portion of the funds should be utilized to stimulate the growth of research activity in "have not" areas of the University (e. g., engineering); at the same time, the funding was to be maintained at a level which would encourage project directors to seek outside support once the program was under way.

(4) A small amount of the grant should be directed toward the support of "high risk" research in which the end result is important enough to

justify a limited high-risk investment.

(5) Programs which fail to meet the standards of performance set by the Committee, or which change significantly in direction to lessen their pertinence to the overall space effort, or which are obviously mature enough to gain independent funding will be denied support or requested to phase out preparatory to obtaining funds elsewhere.

The committee, at the direction of the Research Council, began a series of monthly meetings to determine the most effective way to integrate the resources of the University into the total institutional space effort. One objective will be to integrate the social sciences, including programs in international studies. These discussions are continuing.

An outgrowth of these discussions to date is the development of the concept of an "intellectual spinoff" in the form of an application of University resources to the problems of society engendered by extension of man's environment from the confines of earth into outer space. As a unifying theme for the University's effort, the group discussions have centered on the concept, "Evolution to and Continued Survival of Man," which embraces an evolutionary thread in research spanning the origin of earth and life to the problems of continued survival in man's total environment.

The committee is beginning to address itself to the task of implementing this philosophical concept. Eventually, it is planned to direct at least a portion of the Sustaining University Multidisciplinary Grant toward programs which will explore the evolutionary theme from a social and environmental viewpoint. To this end, the Research Council has directed the formation of a Social Sciences Advisory Committee to the Space Research Committee; this group is being constituted at the present time, and will begin to function with its advisory assignment; ultimately, the Council envisions an enlarged Space Science Research Committee to include representation from all social sciences and ultimately perhaps the humanities, reflecting the broadened scope of the research undertaken.

The committee has also encouraged group seminars among the investigators involved in the three subject-matter areas of the grant program (Turbulence, Space Biology and Medicine--Reactions to Environmental Stress, and Engineering; see below). The objective of these group seminars will be to foster a closer relationship of the individual research projects to the subject matter areas of the program. Interrelationships between subject matter areas will follow.

All of these activities are closely monitored by the Research Council (Appendix B), in order to effect a meaningful integration of the interdisciplinary

space research effort with total University research and academic objectives.

III. PROGRAM ACTIVITIES

The initial roster of supported projects which began operations on or about April 1, 1966 is shown in Table I. Each investigator was required to report his progress for the period 4/1/66 through 10/31/66, and to submit his plans and budget estimates for the second year of operation, to begin November 1, 1966. The committee reviewed the progress reports and the requests for continuation. Allocations for the second year were adjusted and assigned to each project, as shown in Table II.

A summary of projected budgets for the period ending 10/31/66 is shown as Table III; projected budget summary for the year beginning 11/1/66 is shown in Table IV.

Major changes brought about by review of the first progress reports are summarized below:

(1) The project, "Triaxial Short Life Fatigue at Cryogenic Temperature," Dr. G. Libertiny, Department of Mechanical Engineering, was reduced to a minimum level of funding to sustain the program until external sources of funding could be obtained. The committee felt that the project had developed beyond the scope of the present program and was progressing in a direction inconsistent with the space program objectives.

(2) Professor Blake King, principal investigator on the project "Sublimation of Alloy Constituents at High Temperatures and Low Pressures," was replaced by Dr. Alan Wolfenden (biography attached) when Professor King's duties as acting department chairman prevented him from active direction of the program.

(3) Dr. Joseph Hirschberg, chairman of the Department of Physics, and former director of the Plasma Research Laboratory at Princeton, joined Dr. Robertson on the project "Effects of Ion Creation and Loss Processes on Plasma Turbulence and Stability." Dr. Hirschberg will assist in the application of important optical methods of analysis to the program. (Biography attached)

(4) A new project, "Temperature Effects on Membrane Phenomena," under the direction of Dr. Walter Drost-Hansen (biography attached) of the Institute of Marine Science, was provided limited funds to begin investigations which would add a new area of interest to the broad objective of investigating reactions to environmental stress.

(5) Dr. Behram Kursunoglu, Director of the Center for Theoretical Studies, was awarded \$2500 toward support of the Fourth Coral Gables Conference on Symmetry Principles at High Energy (program attached). The funds supplement those obtained from AFOSR, NSF, ONR, and AEC in support of this important international conference.

TABLE I

Programs Selected for Support Under NASA NGR 10-007-010
November 1, 1965 - October 31, 1966

TURBULENCE

Dr. B. Kursunoglu Theoretical Studies	Turbulent Diffusion Processes in Laboratory and Cosmic Plasmas	\$ 16,831
Dr. H. Robertson Physics	Effects of Ion Creation and Loss Processes on Plasma Turbulence and Stability	25,075
Dr. Russell Snyder Inst. Marine Science	Wave-Induced Ocean Turbulence	16,069

SPACE BIOLOGY AND MEDICINE--
REACTIONS TO ENVIRONMENTAL STRESS

Dr. Carl Williams Psychology	Psychological Study of Human Response to Stress	11,110
Dr. Frank Moya Anesthesiology	Effects of Alterations in Atmospheric Environment on Reproduction	12,400
Dr. W. Hulet Medicine	Renal Response to Zero Gravity	1,850
Dr. B. Sallman Microbiology	Effects of Environmental Factors Found in Space on the Growth Metabolism of Nondividing Cells	22,060
Drs. Iverson & Clegg Biology	Physiological and Biological Alterations in Cryptobiotic Organisms	13,878

ENGINEERING

Dr. G. Libertiny Mech. Engr.	Triaxial Short Life Fatigue at Cryogenic Temperatures	5,486
Prof. Blake King Mech. Engr.	Sublimation of Alloy Constituents at High Temperatures and Low Pressures	8,196
Dr. T. Veziroglu Mech. Engr.	Thermal Conductance of Contacts	24,075
Dr. A. Condom Elec. Engr.	Antenna Patterns in Ionized Media	4,100
Total Allocations (Direct Costs Only)		<hr/> \$161,130

Programs Selected for Support Under NASA NGR 10-007-010
November 1, 1966 - October 31, 1967

TURBULENCE

Dr. B. Kursunoglu Theoretical Studies	Turbulent Diffusion Processes in Laboratory and Cosmic Plasmas	\$ 17,600
Drs. Robertson and Hirschberg Physics	The Effects of Ion Creation and Loss Processes on Plasma Turbulence and Stability	17,775
Dr. Russell Snyder Inst. Marine Science	Wave-Induced Ocean Turbulence	18,676

SPACE BIOLOGY AND MEDICINE--
REACTIONS TO ENVIRONMENTAL STRESS

Dr. Carl Williams Psychology	Psychological Study of Human Response to Stress	14,644
Drs. Moya & Smith Anesthesiology	Reproductive Effects of Artificial Ambients	21,700
Dr. W. Hulet Medicine	Renal Response to Zero Gravity	6,000
Dr. B. Sallman Microbiology	Effects of Environmental Factors Found in Space on the Growth Metabolism of Nondividing Cells	19,285
Drs. Iverson & Clegg Biology	Physiological and Biochemical Alterations in Cryptobiotic Organisms	15,700
Dr. W. Drost-Hansen Inst. Marine Science	Temperature Effects on Membrane Phenomena	5,500

ENGINEERING

Dr. G. Libertiny Mech. Engineering	Triaxial Short Life Fatigue at Cryogenic Temperature	10,500
Dr. A. Wolfenden Mech. Engineering	Sublimation of Alloy Constituents at High Temperatures and Low Pressures	17,773
Dr. T. Veziroglu Mech. Engineering	Thermal Conductance of Contacts	22,085
Dr. A. Condom Elec. Engineering	Antenna Patterns in Ionized Media	7,099

SPECIAL

Dr. B. Kursunoglu Theoretical Studies	Support for Fourth Coral Gables Conference on Symmetry Principles at High Energy	2,500
Total Allocations (Direct Costs Only)		<hr/> \$ 196,837*

*Includes carry-over from first year.

TABLE III

SUMMARY OF BUDGETS

NASA 10-007-010 First Year (11/1/65-10/31/66)

Original Approved Budgets

Sub Acct.	Acct. No.	Principal Investigator	"A"	"B"	"C"	Total		Total NASA
						Direct	Indire ct*	
1	7387	Dr. Kursunoglu	15,969	862		16,831	3,366	20,197
2	8360	Dr. Robertson	5,450	1,750	17,875	25,075	4,915	29,990
3	8743	Dr. Snyder	5,640	2,700	7,729	16,069	3,054	19,123
4	8311	Dr. Williams	5,140	1,350	4,620	11,110	2,182	13,292
5	5276	Dr. Moya	7,250	650	4,500	12,400	2,480	14,880
6	5277	Dr. Hulet	1,500	350	--	1,850	370	2,220
7	5280	Dr. Sallman	7,850	1,050	13,160	22,060	4,412	26,472
8	8415	Drs. Iverson/Clegg	4,900	2,068	6,910	13,878	2,776	16,654
9	8502	Dr. Libertiny	1,106	380	4,000	5,486	1,097	6,583
10	8503	Prof. King	3,516	2,580	2,100	8,196	1,639	9,835
11	8504	Dr. Veziroglu	7,355	1,300	15,420	24,075	4,715	28,790
12	8505	Dr. Condom	3,600	500	--	4,100	820	4,920
Totals			69,276	15,540	76,314	161,130	31,826	192,956

"A" Salaries

"B" Supplies and Services

"C" Capital Equipment

*20% of total direct costs, excluding
computer

TABLE IV

SUMMARY OF BUDGETS

NASA 10-007-010, Supplement #1 Second Year (11/1/66-10/31/67)

Original Approved Budgets

Sub Acct.	Acct. No.	Principal Investigator	"A"	"B"	"C"	Total		Total NASA
						Direct	Indirect*	
1	5484	Dr. Sallman	14,700.00	3,585.00	1,000.00	19,285.00	3,857.00	23,142.00
2	5485	Drs. Moya/Smith	15,500.00	3,700.00	2,500.00	21,700.00	4,340.00	26,040.00
3	7389	Dr. Kursunoglu	16,172.09	1,427.91	--	17,600.00	3,520.00	21,120.00
4	5490	Dr. Hulet	4,500.00	1,500.00	--	6,000.00	1,100.00	7,100.00
5	8512	Dr. Condom	6,599.00	500.00	--	7,099.00	1,420.00	8,519.00
6	7553	Drs. Iverson/Clegg	10,700.00	3,500.00	1,500.00	15,700.00	3,140.00	18,840.00
7	8323	Drs. Robertson/ Hirschberg	13,900.00	2,950.00	925.00	17,775.00	2,955.00	20,730.00
8	8516	Dr. Libertiny	6,200.00	100.00	4,200.00	10,500.00	2,100.00	12,600.00
9	8827	Dr. Snyder (IMS)	8,300.00	5,570.00	4,806.00	18,676.00	3,375.00	22,051.00
10	8313	Dr. Williams	10,734.00	2,500.00	1,410.00	14,644.00	2,889.00	17,533.00
11	8517	Dr. Veziroglu	14,476.00	3,109.00	4,500.00	22,085.00	4,242.00	26,327.00
12	8518	Dr. Wolfenden	8,709.00	1,880.00	7,184.00	17,773.00	3,555.00	21,328.00
13	7391	Dr. Kursunoglu	1,000.00	1,500.00	--	2,500.00	500.00	3,000.00
14		Dr. Drost-Hansen	4,800.00	--	700.00	5,500.00	1,100.00	6,600.00
Totals			136,290.09	31,821.91	28,725.00	196,837.00	38,093.00	234,930.00

"A"	Salaries	Unallocated balance - first year	4,845.00
"B"	Supplies and Services	Unallocated balance- second year	200,000.00
"C"	Capital Equipment	Transfer sub account balances	
		from 1st year accounts (estimated)	33,910.24
		Total available for distribution	238,755.24
		Approved budgets per above list	234,930.00
		Unallocated balance	<u>3,825.24</u>

*20% of total direct costs, excluding computer

APPENDIX A

UNIVERSITY RESEARCH COUNCIL

SPACE RESEARCH COMMITTEE

Dr. F. F. Koczy (Chairman)	Chairman, Physical Sciences Div. Institute of Marine Science
Dr. James S. Clegg	Associate Professor of Zoology Department of Biology College of Arts and Sciences
Dr. John Curtiss	Professor of Mathematics College of Arts and Sciences
Dr. Sidney W. Fox	Professor of Biochemistry and Director, Institute of Molecular Evolution
Dr. Mose L. Harvey	Director, Center for Advanced International Studies
Dr. Bernard E. Howard	Professor of Mathematics College of Arts and Sciences
Dr. William H. Hulet	Associate Professor of Medicine and Physiology, School of Medicine
Dr. William C. Knopf	Dean, School of Engineering
Dr. Behram Kursunoglu	Director, Center for Theoretical Studies
Dr. E. H. Man	Dean of Research Coordination
Dr. J. J. Moder	Professor of Industrial Engineering School of Engineering
Dr. S. Fred Singer	Professor of Atmospheric Science School of Environmental and Planetary Sciences

APPENDIX B

UNIVERSITY OF MIAMI RESEARCH COUNCIL 1966-67

College of Arts and Sciences (3 representatives)

Dr. Douglas Browning , Department of Philosophy
Dr. Casimir T. Grabowski, Department of Biology
Dr. Alexander Wallace, Department of Mathematics

School of Medicine (3 representatives)

Dr. L. S. Dietrich, Department of Biochemistry
Dr. William H. Hulet, Departments of Medicine & Physiology
Dr. Morris Rockstein, Department of Physiology

School of Environmental and Planetary Sciences (3 representatives)

Dr. Leonard J. Greenfield, Institute of Marine Science
Dr. Fritz F. Koczy, Institute of Marine Science
Dr. Charles B. Metz, Institute of Molecular Evolution

School of Education (1 representative)

Dr. George J. Mouly, Professor of Education

School of Business Administration (1 representative)

Dr. Waino W. Suojanen, Department of Management

School of Law (1 representative)

Mr. Thomas A. Wills

School of Engineering (1 representative)

Dr. Joseph H. Moder

Ex officio members

Dr. Eugene H. Man, Dean of Research Coordination
Dr. John A. Harrison, Dean of Graduate School
Dr. D. Bailey Calvin, Assistant Dean for Research, School of
Medicine

APPENDIX C

BIOGRAPHICAL INFORMATION

Dr. Walter Drost-Hansen Institute of Marine Science	C 1
Dr. Joseph G. Hirschberg Department of Physics	C 3
Dr. Alan Wolfenden Department of Mechanical Engineering	C 5

BIOGRAPHICAL INFORMATION

Walter Drost-Hansen

Professor of Chemical Physics, Institute of Marine Science,
University of Miami

Date and Place of Birth:

September 29, 1925, Chicago, Illinois

Degree:

Magister scientiarum (Ph.D. equivalent) University of Copenhagen,
Denmark, 1950

Positions Held:

Teacher of inorganic, qualitative analysis to chemical engineering
students, Denmark Technical University, Copenhagen, Denmark
1945-1946

Junior Scient. Collaborator, Institute of Theor. Physics, Copenhagen,
Denmark 1946-1950

Spec. Research Assistant, Illinois Institute of Technology, Chicago,
Illinois 1950-1951

Section Leader, Research Chemist, Bjorksten Research Laboratory,
Madison, Wisconsin, 1951-1952

Associate Professor, Chem. Phys., New Mexico Institute of Mining
and Technology, Socorro, New Mexico 1953-1956

Senior Research Engineer, Pan American Petrol. Corp., Tulsa,
Oklahoma 1956-1961

Senior Research Chemist, Jersey Production Research Co., Tulsa,
Oklahoma 1961-1964

Membership in Societies:

Denmark Chemical Society

American Association for the Advancement of Science

American Association of University Professors

American Chemical Society

American Society of Microbiologists

New York Academy of Sciences

Special Research Interests:

Methodology of science teaching; sponsor of Science Club, Science Fair projects
Instrumentation for open heart surgery by pump procedures and hypothermia
Philosophical aspects of modern physics

Publications: (listed are a few of the most recent)

Two papers published early in 1965 (Industrial & Engineering Chemistry, March and April issues, 1965) have been reprinted in monograph form as the symposium proceedings entitled "Chemistry and Physics of Interfaces" edited by Sidney Ross. American Chemical Society publication.

Drost-Hansen, W.: "Anomalies in the properties of water." Proceedings of the First International Symposium of Water Desalination, October 1965.

Drost-Hansen, W.: "Comments on the structure of water near interfaces." Conference on "Kinetics and Mechanism in Aqueous Inorganic Systems" at the Tropical Oceanography Conference, November 1965, Miami, Florida.

Drost-Hansen, W.: "The higher-order phase transition in the structure of water near 45°C and the treatment of cancer by hyperthermia." Abstract, 2nd International Biophysics Congress, Vienna, Austria, September 1966.

Thorhaug, Anita and W. Drost-Hansen: "Thermal anomalies in membrane properties." Abstract, 2nd International Biophysics Congress, Vienna, Austria, September 1966.

BIOGRAPHICAL INFORMATION

Joseph G. Hirschberg

Professor of Physics, University of Miami

Date and Place of Birth:

April 13, 1921, Chicago, Illinois

Degree:

A. B.	1943	Dartmouth College
M. S.	1951	University of Wisconsin
Ph. D.	1952	University of Wisconsin

Professional Experience:

USAAF, Weather Service, active and reserve, (Pvt. to Capt.)	1943-56
Teaching Assistant, University of Wisconsin	1947-48
Research Assistant, University of Wisconsin	1948-52
Fulbright Scholar, Ecole Normale Supérieure, Paris, France	1952-53
Research Associate, University of Wisconsin	1953-58
President, Federal Engineering Company, Madison, Wisconsin, and Registered Professional Engineer, Wisconsin	1952-58
Head, Optical Group, Plasma Physics Laboratory, Princeton University	1958-65
Research Physicist, Princeton University	1961-65
Professeur d'Exchange, Université de Paris, France	1964
Professor and Chairman, Department of Physics, University of Miami, Coral Gables, Florida	1965-
Consultant, Plasma Physics Laboratory, Princeton University	1965-

Membership in Societies:

Phi Beta Kappa
American Physical Society
American Optical Society
Society of Sigma Xi

Fields of Interest:

Atomic Spectra, Physical Optics, Fabry-Perot Interferometry,
Sodium in the high atmosphere, Plasma Spectroscopy.

Publications: (Listed are some of the most recent among over 40 publications)

J. G. Hirschberg, C. Breton, and R. Chabbal: Method of application of the multichannel Fabry-Perot interferometer to spectral lines of differing widths. Proceedings of the 3rd Symposium on Engineering Problems in Thermonuclear Research, Munich (1964).

J. G. Hirschberg: The use of interference spectroscopy methods in plasma physics. Invited paper read before the 3rd National Meeting, Society for Applied Spectroscopy, Cleveland, Ohio (1964).

J. G. Hirschberg and P. Camus: Spectroscopic observations on a continuous reflex discharge in a strong magnetic field. Proceedings of the 6th Annual Meeting of the Plasma Physics Division of A. P. S., New York (1964).

J. G. Hirschberg: Simple duochromator for the measurement of mass motion in a plasma. Applied Optics 4: 243 (1965).

J. G. Hirschberg: A device for accurately bending a light beam through small angles. Applied Optics 4: 759 (1965).

Peter Platz and J. G. Hirschberg: Etude de la température Doppler dans une décharge toroïdale à l'aide d'un interféromètre Fabry-Perot multicanal. Comptes Rendus Acad. Sc. Paris, 261: 1207 (1965).

J. G. Hirschberg and P. Platz: A multichannel Fabry-Perot interferometer. Applied Optics 4: 1375 (1965).

J. G. Hirschberg, and Einar Hinnov: Neutral temperatures in model-C Stellarator Ohmic heating discharges and afterglow. Bull. Am. Phys. Soc. 11: 564. Also, Princeton University MATT 426. (1966)

Albert Haberstich and J. G. Hirschberg. Induced plasma rotation in the model-C Stellarator. Bull. Am. Phys. Soc. 11: 564, (1966).

BIOGRAPHICAL INFORMATION

Alan Wolfenden

Assistant Professor of Mechanical Engineering

Date and Place of Birth:

September 4, 1940, Royton, Lancashire, England

Degree:

B. S. Hons. in Metallurgy	1961	University of Liverpool
Ph. D. in Metallurgy	1965	University of Liverpool

Former Employer:

Metals and Ceramics Division, Oak Ridge National Laboratory,
operated by the Union Carbide Nuclear Corp., for U.S.A.E.C.;
Dec. 1964 - Sept. 1966.

Experience:

Principally in the field of plastic deformation and work hardening.

Liverpool: Ph. D. thesis on the development and operation of a tensile deformation calorimeter to measure the energy relations involved in the deformation of metal single crystals at low temperatures as a function of strain and orientation; growth of copper and aluminum single crystals; control of grain size of copper and aluminum samples; orientation of crystals by X-ray Laue Techniques; examination of single crystals by radiographic methods.

O. R. N. L.: Operation of a tensile deformation calorimeter to investigate the energy terms involved in the deformation of metals at room temperature; growth of copper single crystals with controlled orientations (i.e. "seeding" crystals); design and development of an impact calorimeter to measure the energy effects associated with the room temperature deformation of metals at relatively high strain rates and to measure the annealing kinetics of the metals immediately after deformation with a view to identifying the defect(s) mobile in copper at room temperature.

Publications:

Nomenclature of metallic elements. *Nature* 211: 632 (1966).

The energy stored in copper single crystals. Accepted for publication in *Acta Metallurgica*.